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A CREEL SURVEY ON BASS AND BOOT
LAKES, OCONTO COUNTY, WISCONSIN,
DECEMBER 1981-SEPTEMBER 1982

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ABSTRACT

A random stratified creel survey was conducted from 13 December 1981 through 30 September 1982 on Bass and Boot lakes, two popular fishing lakes in Oconto County, Wisconsin.

Bass Lake fishing pressure was estimated at 6,905 angler hours, or 49 angler hours/acre. Anglers caught an estimated 9,606 fish and harvested 7,091. The catch rate was estimated at 1.47 fish/angler hour, and the harvest rate at 1.13 fish/hour. Most of the fish caught and harvested were panfish, with over 80% of the total harvest consisting of yellow perch (Perca flavescens).

Boot Lake fishing pressure was estimated at 23,368 angler hours, or 100 angler hours/acre. Anglers caught an estimated 25,480 fish and harvested 17,075. Catch rate for the survey period was an estimated 1.14 fish/angler hour, and the harvest rate was 0.78 fish/hour. Most of the fish caught and harvested were panfish, with bluegill (Lepomis macrochirus) and yellow perch dominating the harvests.

Population size, exploitation rate, and total mortality were estimated for some of the species captured. These factors are discussed, along with angler characteristics and management implications for the sport harvest.

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INTRODUCTION

The purposes of this study were to compare the population and harvest characteristics of Bass and Boot lakes, two popular fishing lakes in northeastern Wisconsin, and then to explain the lack of large yellow perch in Bass Lake. From 13 December 1981 through 30 September 1982 a creel survey was conducted on both lakes, which are located in Oconto County near Lakewood, a popular recreation area in the Nicolet National Forest (Fig. 1).

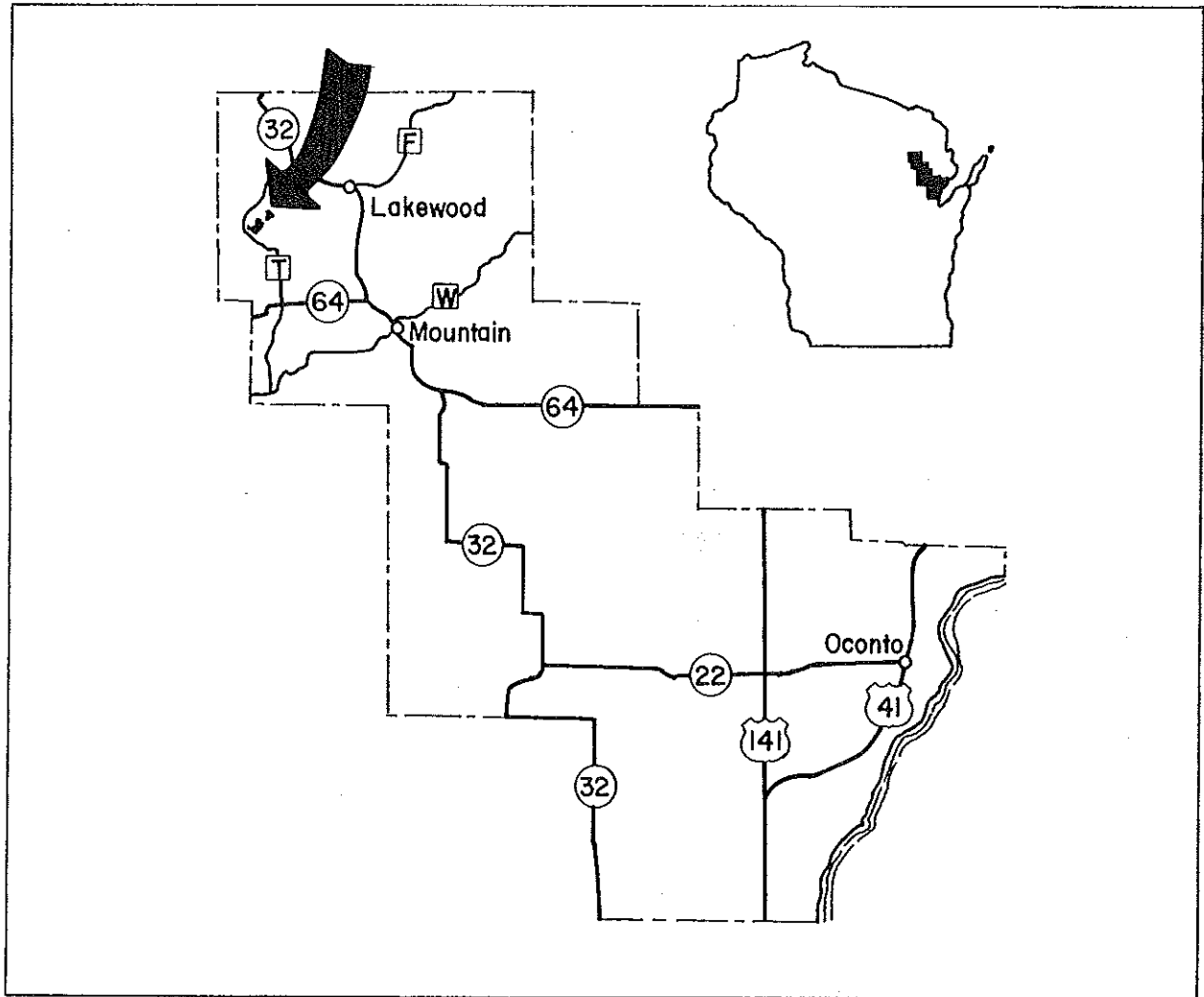


FIGURE 1. Location of Bass and Boot lakes, Oconto County, Wisconsin.

Bass and Boot lakes have similar physical characteristics. Bass Lake is a 142-acre seepage lake with a maximum depth of 40 ft and medium-hard water that is highly transparent (Fig. 2). Littoral area is composed of 80% sand, 15% muck, and 5% gravel. Bass Lake's shoreline is primarily upland, consisting of mixed hardwoods and conifers, with a small shrub marsh located along the

northwest shoreline. Access to the lake is available at an improved site maintained by the U.S. Forest Service along the southeast shore. Forest Service personnel also maintain a public swimming beach and picnic area near the access site.

Boot Lake is a 235-acre seepage lake with medium-hard, clear water and a maximum depth of 38 ft (Fig. 2). Littoral area is composed of 65% sand, 20% muck, 10% rubble, and 5% gravel. Boot Lake's shoreline is entirely upland, consisting of mixed hardwoods and conifers. Access to the lake is available at an improved site located in the Nicolet National Forest campground on the northwest shoreline. Access is also available at a road right-of-way on the lake's southeast corner and at a private area located along the northeast shoreline.

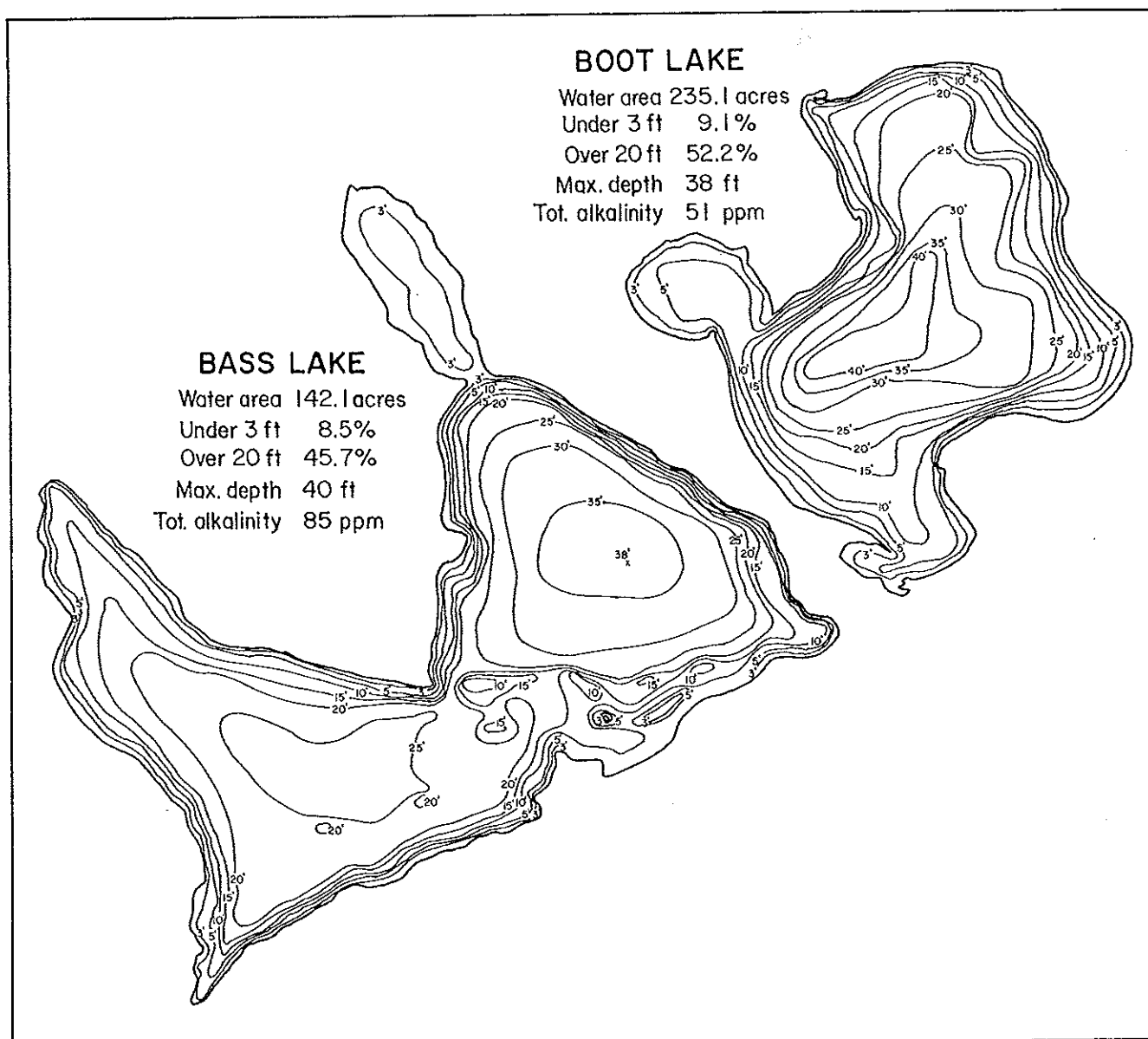


FIGURE 2. Depth contour maps of Bass and Boot lakes, Oconto County, Wisconsin.

Additional information on each lake is available from the Wisconsin Department of Natural Resources surface waters inventory for Oconto County (Carlson 1977) and from unpublished data collected during this survey. Fish species for each lake are listed in Table 1.

TABLE 1. Fish species composition of Bass and Boot lakes, Oconto County, Wisconsin.

Species	Scientific Name	Lake	
		Bass	Boat
Gamefish			
Largemouth bass	<u>Micropterus salmoides</u>	x	x
Northern pike	<u>Esox lucius</u>		x
Muskellunge	<u>Esox masquinongy</u>	x	
Rainbow Trout	<u>Salmo gairdneri</u>	x	
Walleye	<u>Stizostedion vitreum vitreum</u>	x	x
Panfish			
Black crappie	<u>Pomoxis nigromaculatus</u>	x	x
Bluegill	<u>Lepomis macrochirus</u>	x	x
Green sunfish	<u>Lepomis cyanellus</u>		x
Pumpkinseed	<u>Lepomis gibbosus</u>	x	x
Rock bass	<u>Ambloplites rupestris</u>	x	x
Yellow perch	<u>Perca flavescens</u>	x	x
Other			
Bluntnose minnow	<u>Pimephales notatus</u>	x	x
Common shiner	<u>Notropis cornutus</u>	x	x
Golden shiner	<u>Notemigonus crysoleucas</u>	x	x
White sucker	<u>Catostomus commersoni</u>	x	x

METHODS

Creel Survey

Following the methods described by Lambou (1961), a random stratified sampling schedule was developed to survey each lake from 13 December 1981 through 30 September 1982.

Anglers were counted every 2 hours from 7:00 a.m. to 5:00 p.m. during the winter and from 6:00 a.m. to 8:00 p.m. during the summer. A 12-hour angling day was assumed for winter months, and a 16-hour day was assumed during the summer. Creel clerks were able to make complete angler counts within 15 minutes. After completing the angler counts, the clerks interviewed anglers and recorded catch information for the remainder of the 2-hour period. Data on fishing pressure and harvest were recorded on standard forms for instantaneous counts and angler interviews (Append. A, B).

Creel clerks recorded the species and length of all fish harvested, along with the angler's age, sex, residence, fishing method, type of bait, and the length of time spent fishing. One interview form was completed for each angler. If anglers were contacted more than once, only the time elapsed since the previous contact and the catch for that time period were recorded.

During the survey, more effort was concentrated on weekends and holidays than on weekdays. Each month and each hourly time period was surveyed equally. One-half of the weekend periods and 30% of the weekday periods were sampled. Weekday and weekend-holiday data were analyzed separately, as were the data for each month. Most of the angler contacts were made on the ice or open water, while fishing trips were still in progress.

Average daily fishing pressure was determined for each lake by multiplying the average number of anglers per count by the number of hours in the survey day. Total fishing pressure for each month was calculated by multiplying the average daily pressure by the total number of weekdays and weekend-holidays in that month.

Use of the term "catch" in this study refers to the number of fish kept or released, while "harvest" refers only to the number of fish that were kept in the angler's creel. Catch and harvest rates were determined by dividing the total recorded number of fish caught or harvested each month by the total number of hours fished for all species during that month. The total number of each species caught and harvested each month was obtained by multiplying the catch and harvest rates by the total estimated fishing pressure for that month. Catch and harvest rates were calculated using data from both complete and incomplete fishing trips.

Population Size

In conjunction with the open water survey, population estimates of panfish and game fish species were calculated, using the Schumacher multiple mark-recapture method and Bailey's modification of the Peterson mark-recapture method (Ricker 1975). The formula for the Schumacher method is

$$\frac{1}{N} = \frac{(MR)}{(CM^2)}$$

where N is the estimated number of fish in population, M is the total number of marked fish, C is the daily catch, and R is the number of daily recaptures. The formula for the Bailey modification is

$$N = \frac{M(C+1)}{R+1}$$

where N is the estimated number of fish in the population, M is the number of marked fish in the population, C is the number of fish caught during the survey, and R is the number of marked fish caught during the survey.

During spring 1982, trap netting and shoreline electrofishing were used for marking fish on each lake. Schumacher's formula was used to calculate immediate population data for both lakes. The creel survey was used to estimate the ratio of marked fish to unmarked fish during the recapture period for use in the Bailey estimates.

During the marking period, fish captured by fyke net were clipped on the right ventral fin, whereas fish captured by shoreline electrofishing were clipped on both the right ventral fin and the top of the tail.

Exploitation

Exploitation rate is the probability that a fish will die from angling activities during a specified time interval, when all causes of death are working in the population. Kempinger et al. (1975) state that the number of marked fish within a given size range that are harvested by anglers during the year after marking can, when expressed as a percent, be used as a direct estimate of the annual exploitation rate. Exploitation in this study was calculated by dividing the estimated total number of harvested marked fish by the total number of marked fish in the population.

Mortality

Total mortality is the measure of all natural and angler-induced sources of mortality in a population. Catch curves were constructed to estimate total mortality for the yellow perch and walleye populations of Bass and Boot lakes (Ricker 1975).

RESULTS

Angling Effort

Of the 622 anglers interviewed on Bass Lake, 181 were interviewed during the winter and 441 during the summer. Of the winter anglers interviewed, only 46 had completed their fishing trips, which averaged 2.8 hours. The remaining winter anglers interviewed had not completed fishing; their trips averaged 3.8 hours. Of the summer anglers interviewed, 131 had completed fishing, and their trips averaged 2.8 hours. A total of 310 summer anglers interviewed had not completed fishing, and their trips averaged 1.7 hours.

Anglers on Bass Lake fished 1,410 hours during the winter survey period (10 angler hours/acre) and 5,495 hours during the summer period (39 angler hours/acre). Anglers completed 504 trips during the winter survey period and 1,963 trips during the summer survey period.

On Boot Lake 1,854 anglers were interviewed, 635 during the winter and 1,219 during the summer. Of the winter anglers interviewed, only 95 had completed fishing, and their trips averaged 3.3 hours. The remaining winter anglers had not completed their trips, which averaged 3.1 hours. Of the summer anglers interviewed, 226 had completed their fishing trips, which averaged 2.8 hours. The remaining summer anglers had not completed their trips, which averaged 1.9 hours.

Anglers on Boot Lake fished 6,249 hours during the winter (27 angler hours/acre) and 17,119 hours during the summer (73 angler hours/acre). Anglers completed 1,894 trips during the winter survey period and 6,114 trips during the summer survey period.

Winter pressure was greatest on weekends in December on Bass Lake and weekends in February on Boot Lake (Fig. 3). Summer pressure reached its peak on weekends in May on Bass Lake and weekdays in June on Boot Lake.

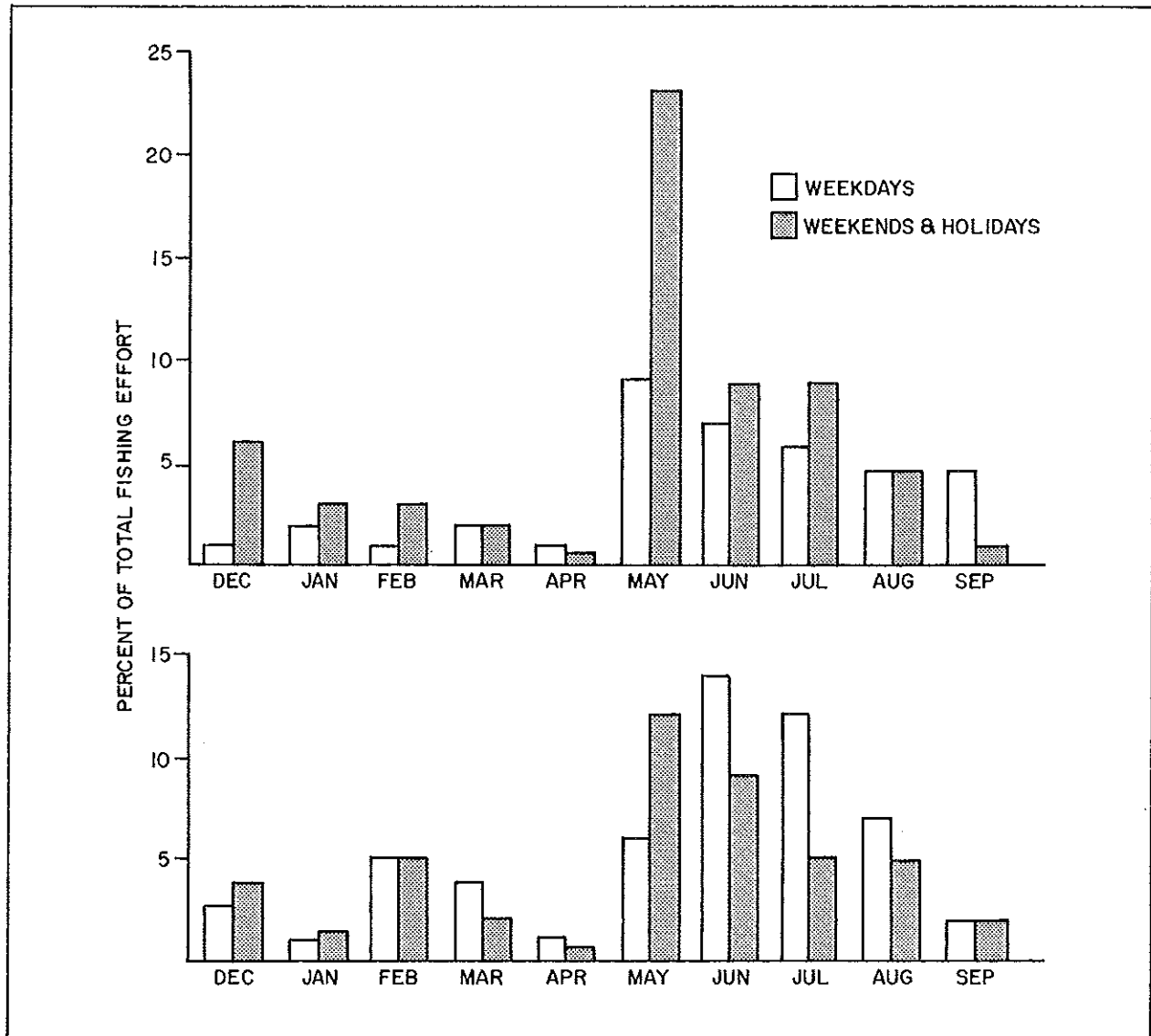


FIGURE 3. Percent of total fishing effort by month in Bass and Boot lakes, Oconto County, Wisconsin, December-September 1981-82.

Winter anglers on Bass Lake preferred fishing in the mid- to late-afternoon during the week and in the midmorning and afternoon on weekends (Fig.4). Summer anglers preferred to fish in the midmorning and late afternoon on weekdays and from midmorning through late afternoon on weekends (Fig.5).

Both winter and summer anglers on Boot Lake preferred fishing from midmorning through late afternoon (Figs. 4, 5). Fishing pressure was highest for both lakes on summer weekends.

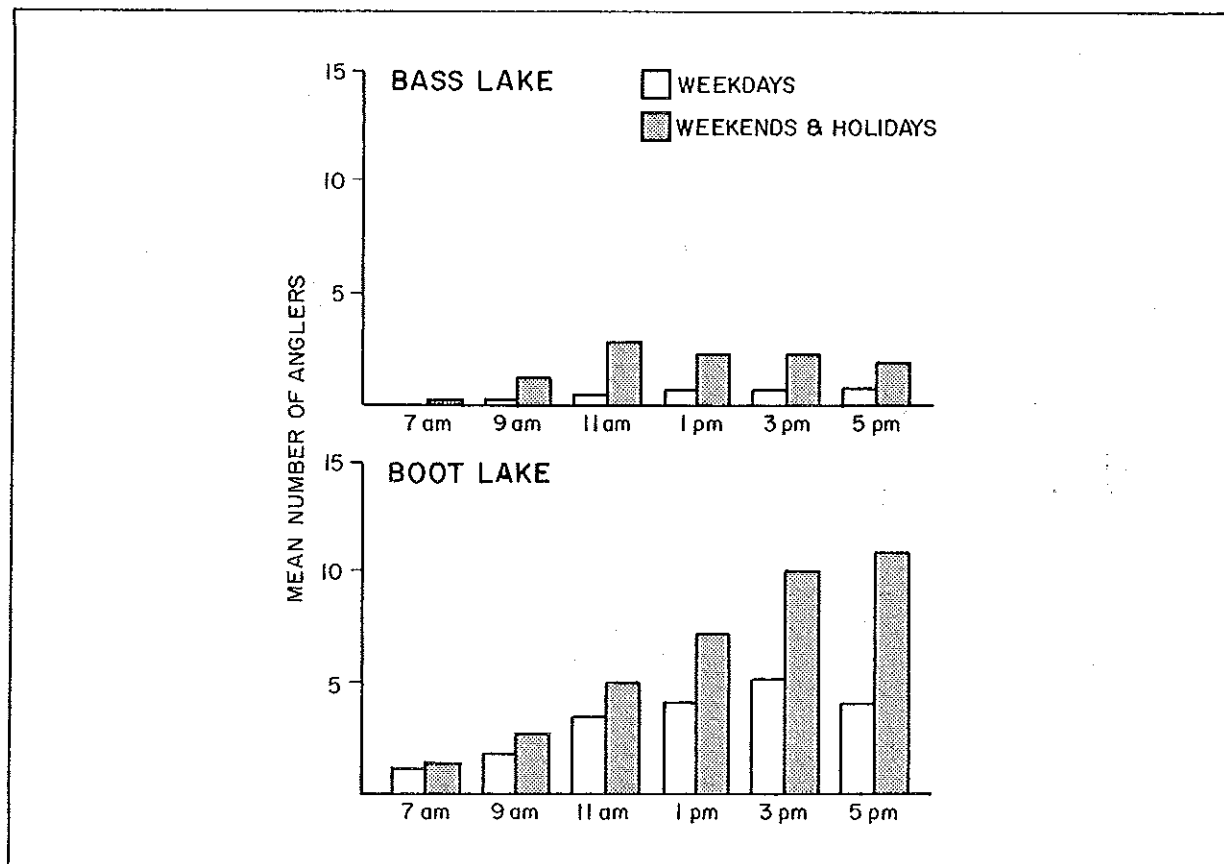


FIGURE 4. Distribution of winter fishing effort (angler numbers) between 7:00 a.m. and 5:00 p.m. on Bass and Boot lakes, Oconto County, Wisconsin, December-April, 1981-82.

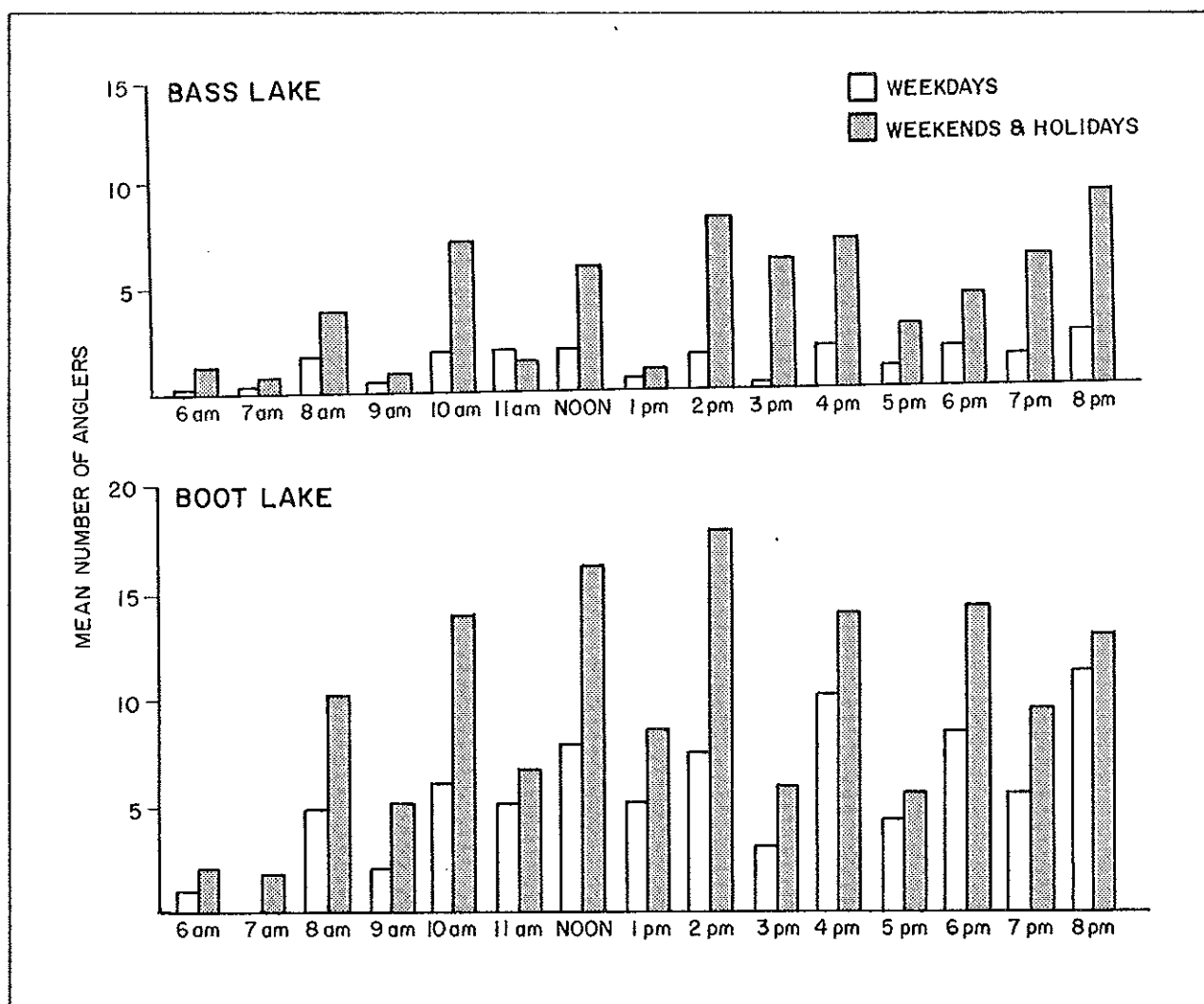


FIGURE 5. Distribution of summer fishing effort (angler numbers) between 6:00 a.m. and 8:00 p.m. on Bass and Boot lakes, Oconto County, Wisconsin, May-September 1982.

Harvest

Yellow perch dominated both the winter and summer harvests from Bass Lake. During the winter, yellow perch was the only species consistently taken, followed by rock bass, bluegill, and black crappie. The largest harvest during summer was yellow perch, followed by walleye, rock bass, and bluegill (Fig. 6).

Yellow perch and bluegill dominated the winter harvest from Boot Lake. Summer harvest was dominated by bluegill, followed by rock bass, yellow perch, and walleye (Fig. 7).

Catch and harvest rates on both lakes fluctuated widely by month and season (Tables 2, 3). Average lengths of fish harvested by season showed little variation on Bass Lake. Seasonal length differences on Boot Lake were only significant for harvested northern pike and walleye (Table 4).

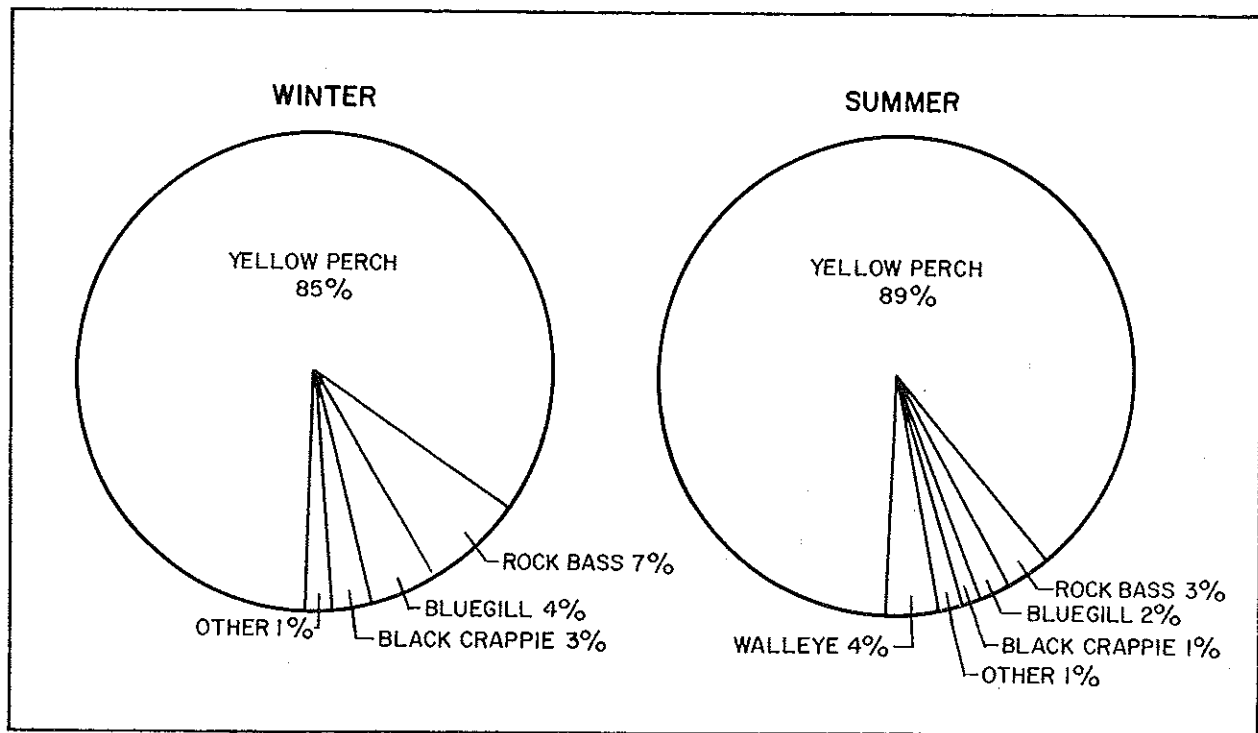


FIGURE 6. A breakdown of angler harvest from Bass Lake, Oconto County, Wisconsin, winter (December-April 1981-82) and summer (May-September 1982).

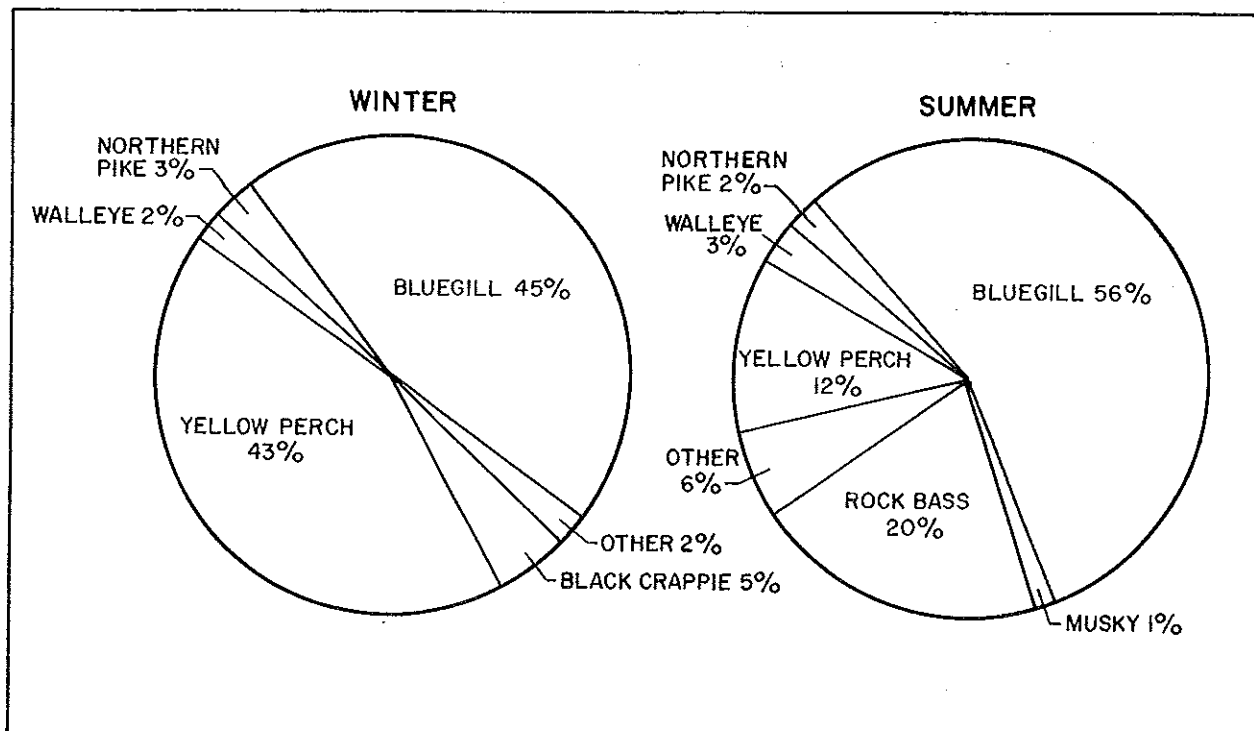


FIGURE 7. A breakdown of angler harvest from Boot Lake, Oconto County, Wisconsin, winter (December-April 1981-82) and summer (May-September 1982).

TABLE 2. Harvest rates of fish species by month from Bass and Boot lakes, Oconto County, Wisconsin, December 1981-September 1982.

Species	Fish/Hour										
	Overall	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Bass Lake											
Yellow perch	0.97	1.55	1.71	0.27	0.21	2.53	1.64	0.08	0.19	0.48	0.73
Bluegill	0.04	--	--	--	0.16	0.98	0.01	0.07	0.03	0.03	0.01
Rock bass	0.06	--	0.01	--	0.36	--	0.04	0.02	0.04	0.02	0.08
Black crappie	0.02	--	--	--	0.07	0.98	--	0.03	0.01	--	--
Walleye	0.03	0.02	--	--	--	--	0.03	0.01	0.08	--	0.06
Rainbow Trout	0.006	0.005	--	0.01	--	--	0.01	0.02	0.005	--	--
Largemouth bass	0.005	--	--	--	--	--	--	0.02	0.01	0.02	0.02
All species	1.13	1.58	1.72	0.28	0.80	4.49	1.73	0.25	0.37	0.55	0.90
Boot Lake											
Yellow perch	0.22	0.49	0.68	0.32	0.43	0.10	0.007	0.19	0.11	0.02	0.04
Bluegill	0.39	0.03	0.01	0.58	0.65	0.33	0.32	0.44	0.25	0.55	0.25
Rock bass	0.08	0.006	0.005	0.02	0.006	0.007	0.11	0.16	0.10	0.18	0.06
Black crappie	0.02	0.03	--	0.03	0.10	0.03	0.01	0.01	0.02	--	0.01
Pumpkinseed	0.02	--	--	0.002	0.01	--	0.02	0.03	0.006	0.03	0.06
Walleye	0.02	0.03	0.02	0.03	--	--	0.03	0.01	--	0.02	0.02
Largemouth bass	0.01	--	--	0.01	--	--	0.02	0.02	0.004	0.01	0.003
Northern pike	0.02	0.04	0.03	0.04	--	--	0.02	0.02	0.004	0.007	0.003
Muskellunge	0.0002	--	--	--	--	--	--	--	0.002	--	--
All species	0.78	0.63	0.75	1.03	1.20	0.47	0.54	0.87	0.50	0.82	0.45

TABLE 3. Estimated number of fish caught and harvested from Bass and Boot lakes, Oconto County, Wisconsin, December 1981-September 1982.

Species	Number Caught		Number Harvested	
	Winter	Summer	Winter	Summer
Bass Lake				
Panfish				
Bluegill	137	394	110	153
Yellow perch	1,923	6,119	1,496	4,582
Rock bass	165	363	117	193
Black crappie	84	72	84	49
Gamefish				
Largemouth bass	9	58	0	53
Walleye	13	221	11	195
Rainbow trout	5	28	5	28
Brown trout	0	15	0	15
Total		9,606		7,091
Boot Lake				
Panfish				
Bluegill	3,070	9,984	2,386	6,375
Yellow perch	3,141	1,644	2,533	1,529
Rock bass	147	5,080	79	2,280
Black crappie	287	203	264	162
Pumpkinseed	19	478	19	409
Gamefish				
Largemouth bass	81	338	34	232
Walleye	179	326	128	281
Northern pike	211	273	181	175
Muskellunge	3	16	0	8
Total		25,480		17,075

TABLE 4. Mean lengths of angler harvest from Bass and Boot lakes, Oconto County, Wisconsin, December 1981-September 1982. Sample size is indicated in parentheses.

Species	Average Length (inches)	
	Winter	Summer
Bass Lake		
Panfish		
Bluegill	7.3 (34)	7.2 (14)
Yellow perch	7.3 (634)	7.5 (869)
Rock bass	7.1 (53)	7.2 (34)
Black crappie	9.6 (22)	10.0 (7)
Gamefish		
Largemouth bass	--	12.1 (8)
Walleye	16.0 (5)	16.9 (35)
Rainbow trout	14.6 (2)	10.1 (4)
Brown trout	--	14.7 (3)
Boot Lake		
Panfish		
Bluegill	6.7 (845)	6.3 (958)
Yellow perch	8.1 (791)	7.6 (208)
Rock bass	6.7 (26)	6.9 (336)
Black crappie	9.4 (87)	8.9 (26)
Pumpkinseed	5.7 (7)	5.6 (70)
Gamefish		
Largemouth bass	10.5 (12)	10.1 (35)
Walleye	15.7 (37)	12.7 (48)
Northern pike	20.1 (53)	18.4 (28)
Muskellunge	--	41.5 (1)

While the catch and harvest rates per hour were higher on Bass Lake, the numbers caught and harvested per acre were greater on Boot Lake. The overall catch rate on Bass Lake was 1.47 fish/hour, with an overall harvest rate of 1.13 fish/hour (Table 2). Bass Lake anglers caught an estimated 68 fish/acre, but kept only 50 fish/acre. Most of the winter and summer anglers interviewed were fishing for yellow perch or walleye (Fig. 8).

On Boot Lake, the overall catch rate for all species was 1.14 fish per hour, with an overall harvest rate of 0.78 fish/hour (Table 2). Boot Lake anglers caught an estimated 108 fish/acre but retained only 73 fish/acre. Most winter anglers wanted walleye, northern pike, or panfish--primarily yellow perch. Summer anglers were fishing for bluegill, rock bass, walleye, and yellow perch.

A successful angler was defined as one keeping any fish. In winter on Bass Lake, successful anglers (55%) outnumbered unsuccessful anglers (45%). The success in summer was reversed, with 59% unsuccessful anglers compared to 41% successful anglers.

A similar winter trend was found on Boot Lake. Successful anglers (55%) outnumbered the unsuccessful (45%), while during summer there were 53% unsuccessful anglers compared to 47% successful anglers.

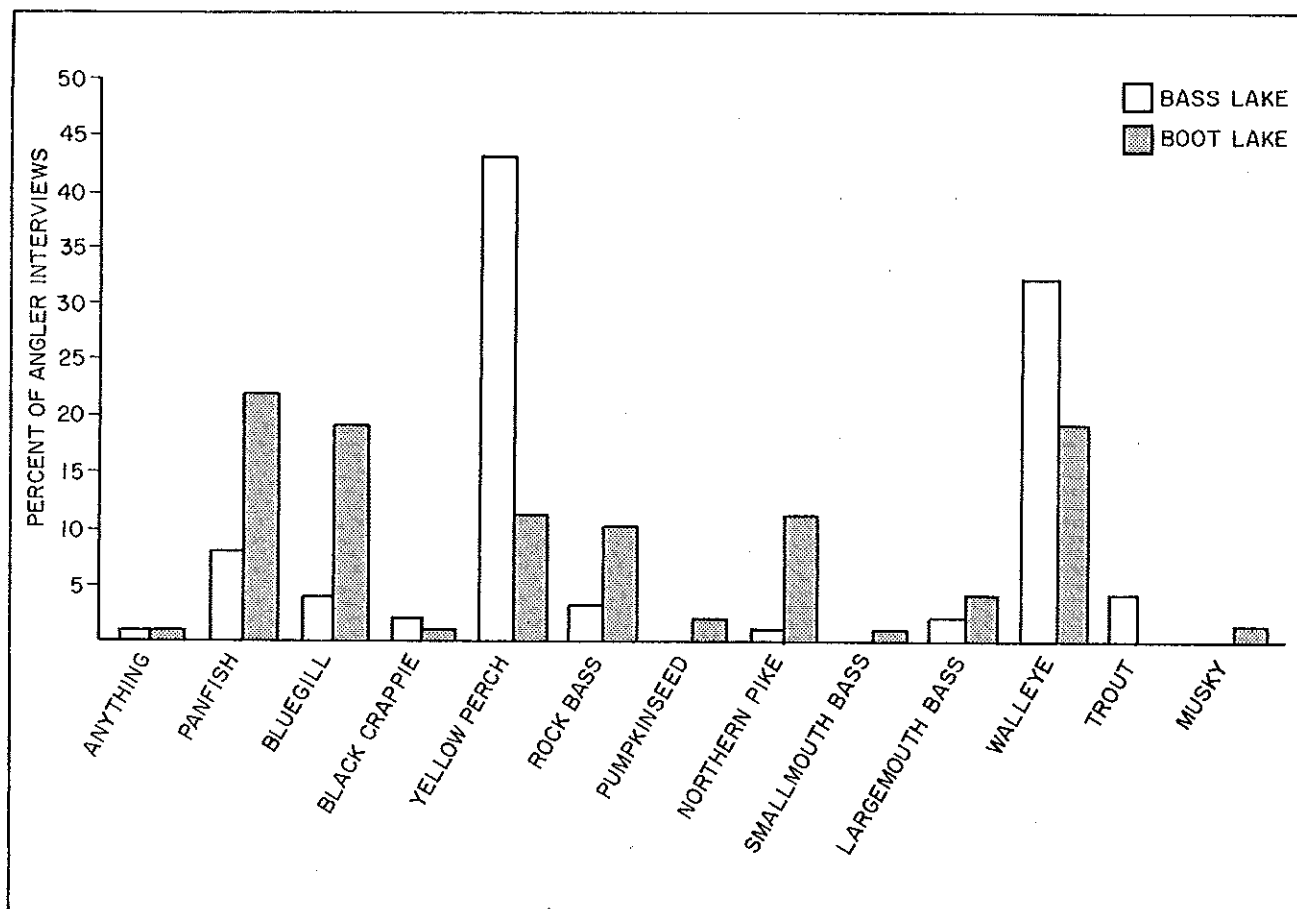


FIGURE 8. Fish species sought by anglers on Bass and Boot lakes, Oconto County, Wisconsin, December-September 1981-82.

Population Estimates

In the spring of 1982 the Bass Lake walleye population was estimated at 807 with 95% confidence intervals of 730 and 903. Based on the creel survey, the estimated population size was 1,298 with confidence intervals of 803 and 1,794. The yellow perch population size was estimated in the spring of 1982 at 5,478 with confidence intervals of 4,771 and 6,430. The population size estimated from creel survey data was 9,846 with confidence intervals of 9,129 and 10,564. The rock bass population size was estimated in the spring at 756 with confidence intervals of 670 and 867. No population estimate from the creel survey was calculated for rock bass, due to the small number of marked fish observed.

Boot Lake population estimates were also calculated. Spring walleye sampling yielded an estimate of 1,443 fish with confidence intervals of 1,238 and 1,730. The walleye population estimate was not computed, due to the small sample of walleyes observed. Largemouth bass population estimates were calculated in the spring at 1,188 with confidence intervals of 797 and 2,334. The estimated population size, based on the creel survey, was 813 with confidence intervals of 292 and 1,334. The spring muskellunge population was estimated at 155 with

confidence intervals of 137 and 179. The northern pike population size was estimated at 213 with confidence limits of 62 and 450. No creel survey estimates were calculated for muskellunge or northern pike, due to the small number of fish observed. The spring estimate for yellow perch was 4,698 with confidence intervals of 4,379 and 5,067, and the creel survey estimate was 18,253 with confidence intervals of 12,185 and 24,320. The rock bass population size was estimated at 7,955 during the spring netting period, with confidence intervals of 7,122 and 9,009, whereas the population estimate based on the creel survey data was 12,878 with confidence limits of 9,429 and 16,326.

Exploitation

Exploitation rates were calculated for the major game fish and panfish species harvested from Bass Lake. Walleye exploitation was estimated at 14%. An estimate of largemouth bass exploitation could not be made because of the small number of bass marked and creeled. Exploitation rates for panfish were estimated at 71% for yellow perch, 21% for bluegill, and 11% for rock bass.

Boot Lake exploitation rates were also calculated. Walleye exploitation was estimated at 7%, and largemouth bass exploitation at 29%. Panfish exploitation was estimated at 39% for bluegill, 31% for black crappie, 21% for yellow perch, and 19% for rock bass.

Total Mortality

Catch curves were used to estimate total mortality on the yellow perch and walleye populations of Bass and Boot lakes. Survey data indicate that the perch on both lakes have low mortality for ages II-IV: 22% on Bass Lake and 36% on Boot Lake. Adding the number of 5-year-olds to both populations increased the mortality rate to 82% on Bass Lake and 58% on Boot Lake. Walleye mortality for ages V-X was calculated at 43% for both lakes.

Walleye

On Bass Lake, most of the walleyes harvested (81%) were taken during May, June, and July. Winter harvest was highest (5%) during December.

Boot Lake harvest followed a similar pattern, with most of the walleyes (63%) taken during May, June, and August. Winter fishing activity was highest (29%) in December and February. January 1982 was a bitterly cold month and may have reduced the fishing pressure and harvest for both lakes.

Muskellunge

This survey indicates that both angler effort and harvest of muskellunge in Boot Lake are quite low (Table 3). Only 1% of the anglers interviewed were specifically fishing for muskies. I estimated that a total of 19 muskies were caught during the survey period, and 8 were harvested. Survey data indicate that most of the muskies caught and harvested are taken as incidental catch.

Yellow Perch

Bass Lake netting data indicate that few yellow perch survive more than five years. Of 4,561 perch caught, 1,861 (41%) were 2-year-olds, 1,564 (34%) were 3-year-olds, and 1,128 (25%) were 4-year-olds, while less than 1% were 5 years old or older.

Spring netting from Boot Lake captured a total of 2,620 yellow perch, of which 1,170 (45%) were 2-year-olds, 867 (33%) were 3-year-olds, 484 (19%) were 4-year-olds, 77 (3%) were 5-year-olds, and 22 (1%) were 6-year-olds.

An average of 43% of the anglers interviewed on Bass Lake were specifically fishing for yellow perch. I estimate that anglers caught 8,042 yellow perch in Bass Lake in 1982, and that 6,078 of these fish were kept. This harvest accounts for the removal of 42.8 yellow perch/acre over the survey period.

On Boot Lake an average of only 11% of the anglers interviewed were specifically fishing for perch. I estimate that anglers in 1982 caught 4,785 yellow perch on Boot Lake and kept 4,062. This harvest accounts for the removal of only 17.3 yellow perch/acre over the survey period.

Bass Lake anglers are harvesting perch with a higher degree of success than Boot Lake anglers. This contrast was particularly evident in May, when 60% of the perch harvest occurred. At that time of the year yellow perch complete their spawning activities, which may make them more vulnerable to harvest.

In May of 1982, Bass Lake yellow perch were concentrated in one area of the lake during the spawning period. One week later, angling effort was observed in the same location. Estimated fishing pressure for May was double that of any other month surveyed. Similarly, May harvest estimates were found to be over five times those of any other month.

Angler Characteristics

Many similarities in angler characteristics were evident in my analysis of the survey data. During both winter and summer, 87% of Bass Lake anglers and 86% of those fishing Boot Lake were male. Most of the anglers interviewed on both lakes were between 16 and 64 years old; however, anglers younger than 16 outnumbered those over 64 by almost 2:1. The majority (98%) of anglers fishing both lakes were Wisconsin residents.

Anglers traveled considerable distances to fish these lakes during both winter and summer. Most of the anglers on Bass Lake lived more than 50 miles away (Fig. 9). Boot Lake anglers traveled similar distances during the summer but not during the winter. (Fig. 10).

Most of the anglers interviewed on both lakes were using live or natural bait (Figs. 11, 12).

Winter anglers on both lakes preferred fishing on open ice to fishing from shanties. During the summer, 98% of the anglers on Bass Lake and 94% on Boot Lake fished from boats.

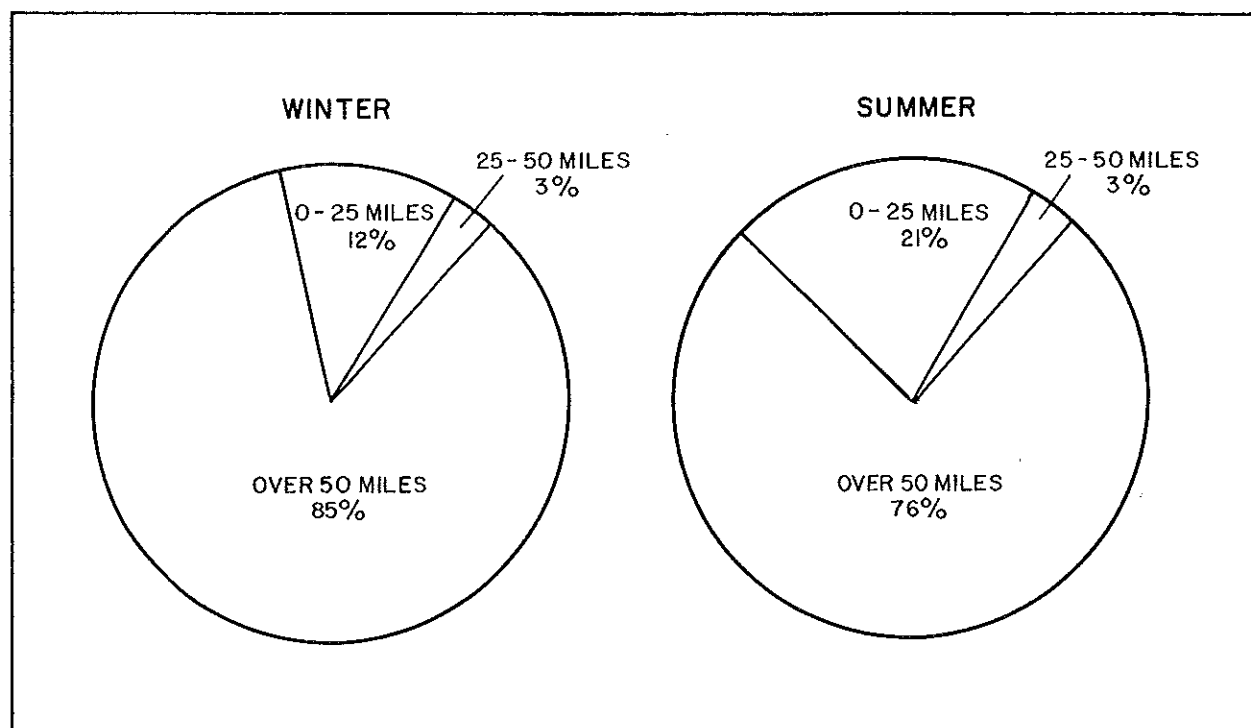


FIGURE 9. Distance travelled by anglers to fish Bass Lake, Oconto County, Wisconsin, winter (December-April 1981-82) and summer (May-September 1982).

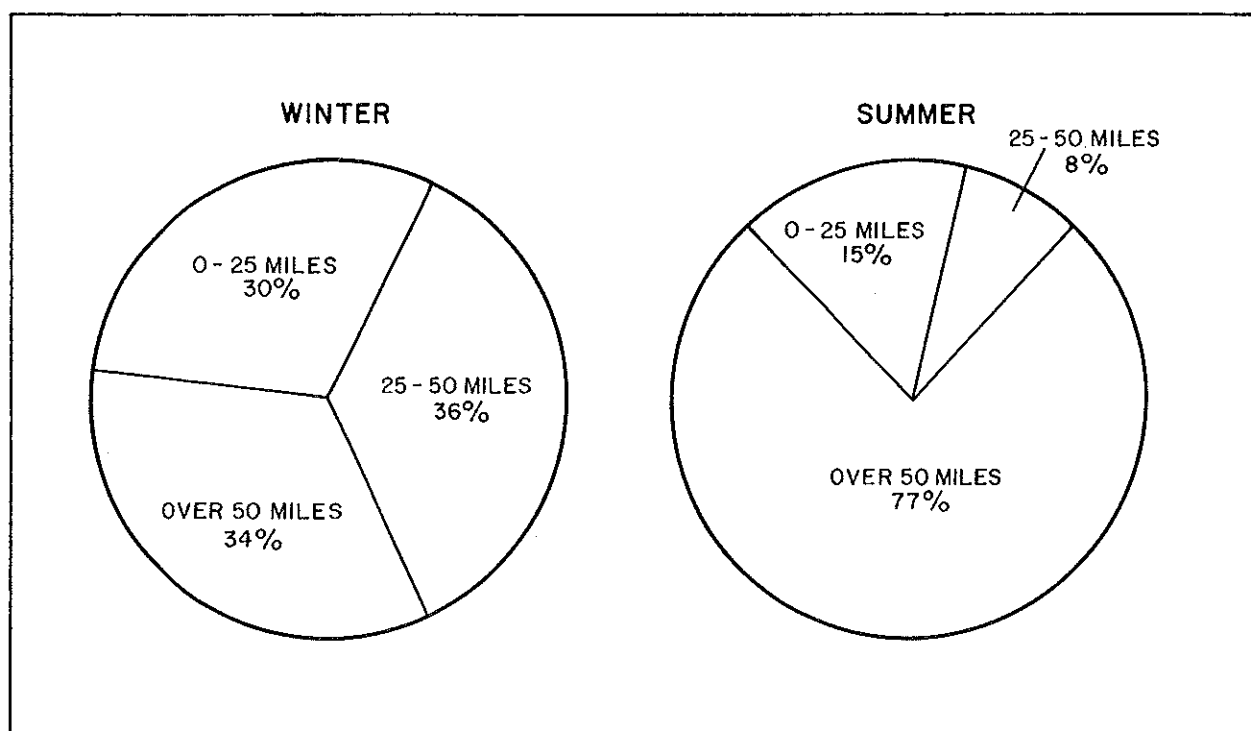


FIGURE 10. Distance travelled by anglers to fish Boot Lake, Oconto County, Wisconsin, winter (December-April 1981-82) and summer (May-September 1982).

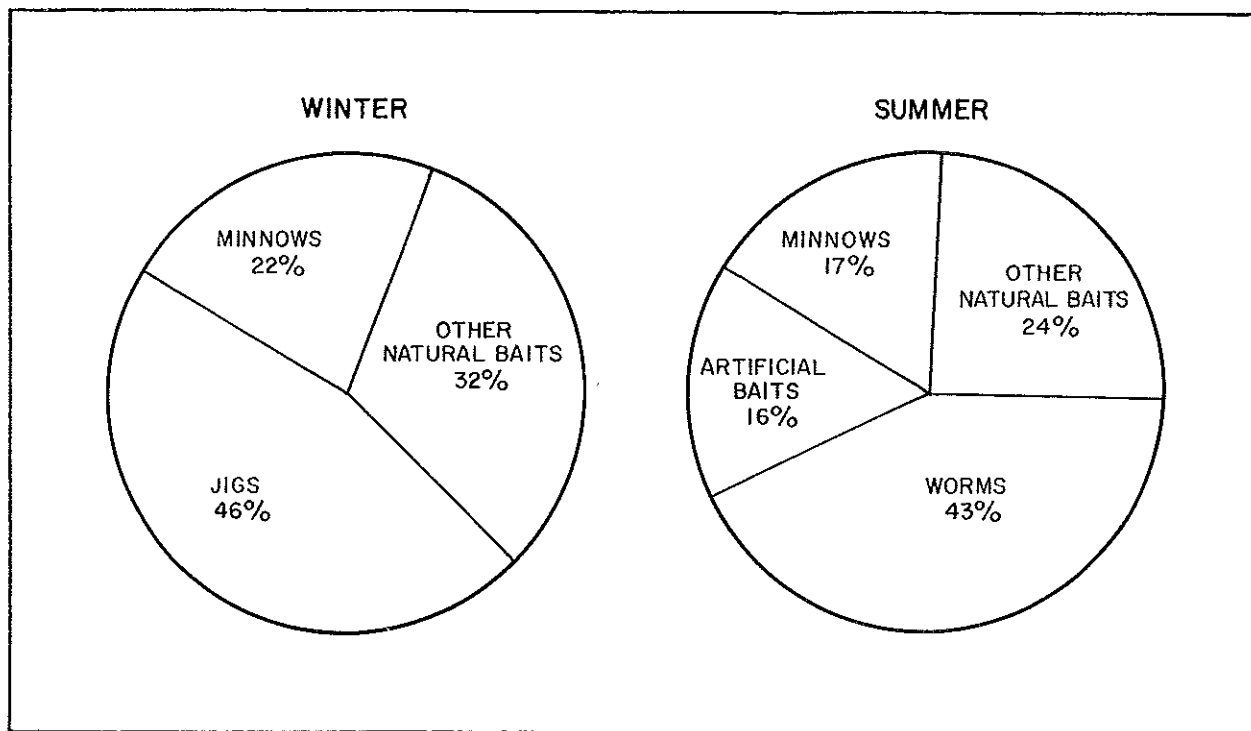


FIGURE 11. A breakdown of baits used by anglers on Bass Lake, Oconto County, Wisconsin, winter (December-April 1981-82) and summer (May-September 1982).

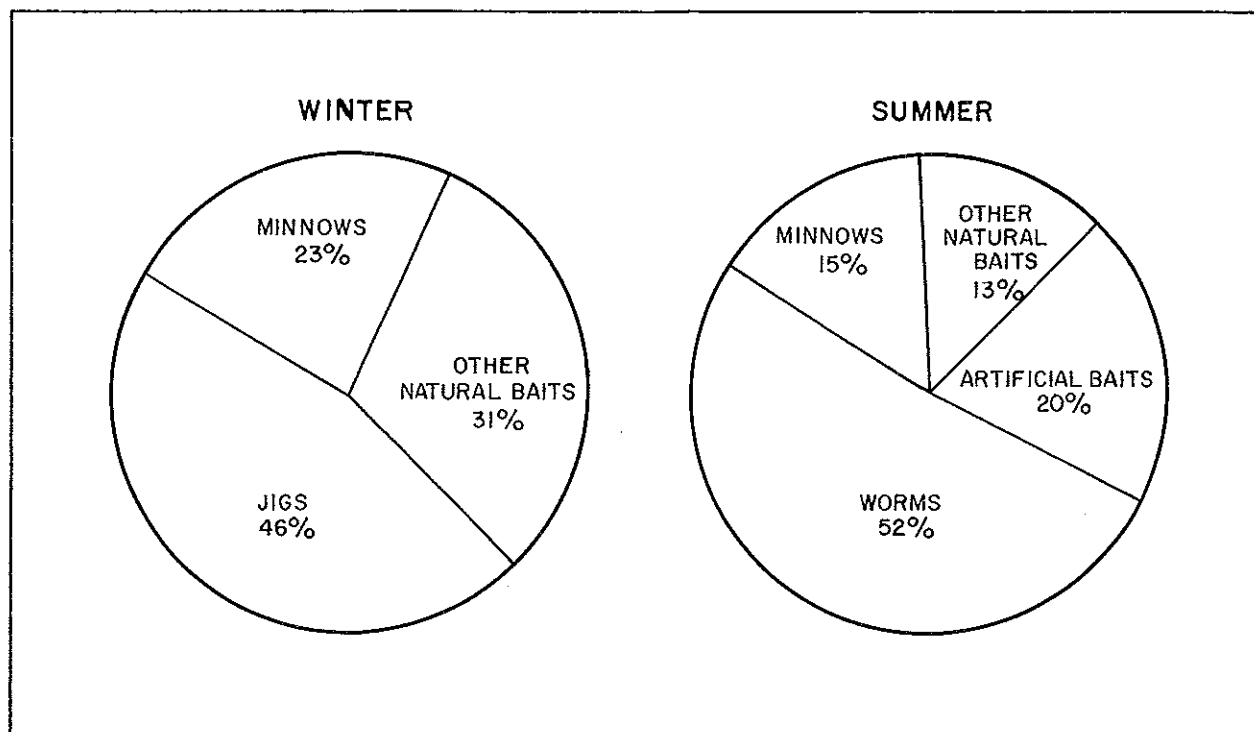


FIGURE 12. A breakdown of baits used by anglers on Boot Lake, Oconto County, Wisconsin, winter (December-April 1981-82) and summer (May-September 1982).

DISCUSSION

Sport fishing on Bass and Boot lakes was investigated and compared to the angling pressure and harvest on other popular fishing lakes in northeastern Wisconsin. A summary of the fishing pressure and harvest rates for these and several other midwestern lakes, along with a comparison of angler exploitation rates for walleye, indicate fishing pressure and harvest rates on Bass and Boot lakes are consistent with those observed in other midwestern lakes (Table 5). Walleye exploitation, however, is below that of the other lakes surveyed.

TABLE 5. A comparison of fishing pressure, harvest rates, and walleye exploitation on midwestern lakes.

Lake	Size (acres)	Angler Hours/Acre	Fish Harvest/Hour	Walleye Exploitation	Reference
Escanaba Lake, WI	293	65	0.84	0.29	Kempinger et al. 1975
Many Point Lake, MN	1,716	17	0.54	0.27	Olson 1958
Murphy Flowage, WI	180	74	1.88	--	Snow 1978
Ridge Lake, IL	18	219	0.75	--	Bennett et al. 1969
14 Minnesota lakes	220-1,783	38	0.79	--	Johnson and Kuehn 1956
12 Michigan lakes	117-675	119	1.22	--	Christensen 1953
8 Michigan lakes	1-130	21	0.81	--	Patriarche 1960
Stormy Lake, WI	522	16	0.62	--	McKnight and Serns 1974
Laura Lake, WI	599	20	0.58	--	McKnight and Serns 1974
Black Oak Lake, WI	584	19	0.74	--	McKnight and Serns 1974
Devils Lake, WI	379	106	0.77	--	Brynildson et al. 1970
Lake Noquebay, WI (Open water only)	2,409	34	1.28	--	Thuemler 1981
(Winter only)	2,409	13	0.65	--	Thuemler 1983
Lake Winnebago, WI	137,708	5	0.42	--	L. Meyers, Wis. Dep. Nat. Resour., unpubl. data
Spirit Lake, IA	5,684	--	--	0.29	Rose 1955
Oneida Lake, NY	51,000	--	0.40	0.24	Forney 1967
Pike Lake, WI	522	--	--	0.22	Mraz 1968
Bass Lake, WI	142	49	1.13	0.14	Present study
Boot Lake, WI	235	100	0.78	0.07	Present study
Cosgrove Lake, WI	92	46	1.26	--	Heizer 1983
Elwood Lake, WI	132	35	1.56	--	Heizer 1983
Shawano Lake, WI	6,178	73	1.09	--	Langhurst 1984

The higher angling pressure observed during the summer on Boot Lake is in part due to extensive use of the U.S. Forest Service campground located on the lake's northwest shore. This facility has the same effect on Bass Lake and on several other lakes in the immediate area. Bass and Boot lakes are popular with both local residents and people from throughout the state, particularly those from the Fox Valley and the greater Milwaukee area.

Both lakes have water-use restrictions that allow water skiing only between the hours of 11:00 a.m. and 4:00 p.m. daily, providing a quiet period for morning and evening fishing. This system works very well for both lakes, as most of the anglers interviewed preferred fishing during these periods.

One of the objectives of this investigation was to explain the lack of large yellow perch in Bass Lake. Other lakes in the surrounding area, such as Boot and Archibald lakes, have significant numbers of yellow perch in the large size ranges. Bass Lake has been surveyed several times since 1966, and very few yellow perch larger than nine inches were caught. During the latest comprehensive survey, in 1978, the lack of large yellow perch was again noted. It was suggested then that heavy cropping due to angling was not the cause of this problem, yet the presence of yellow perch in the same size ranges observed in 1966 and 1974 seems to rule out the possibility of just a few weak year classes. My survey results indicate that concentrated hook and line fishing directed at a single species such as yellow perch can have a significant impact on the population.

MANAGEMENT RECOMMENDATIONS

Bass Lake

Harvest of yellow perch from Bass Lake is too high, especially after the spring spawning period in the northeast corner of the lake (Fig. 1). This area should be closed to fishing from 1 April to 1 June each year to increase the number of large, older fish in the population. This is the most enforceable measure, and it would provide the fastest results, leaving more large fish to be harvested throughout the fishing season.

Boot Lake

I recommend that alternate-year stocking of 500 true muskellunge fingerlings be resumed in Boot Lake. My results indicate that, although Boot Lake has a fine fishery, the muskellunge population has declined since the last survey in 1977, which was also the last year muskies were planted. Interspecific competition between muskie and northern pike is not likely to be the cause of this decline, however, since the northern pike population is also quite low. Boot Lake was found to have suitable spawning habitat and to be capable of supporting muskellunge. Consequently, stocking of muskellunge is warranted in Boot Lake to maintain the population and to provide opportunities to catch trophy fish.

APPENDIX A.

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCESCREEL CENSUS -- INSTANTANEOUS COUNTS
FORM 3600-106 REV. 5-82

CREEL CLERK _____				
COUNTY _____	COUNTY CODE* _____	WATER NAME _____	WATER NUMBER* _____	1. <input type="checkbox"/> LAKE* 2. <input type="checkbox"/> STREAM
CENSUS SITE _____	DATE (MONTH-DAY-YEAR)* _____ / _____ / _____		1. <input type="checkbox"/> WEEKDAY* 2. <input type="checkbox"/> WEEKEND/HOLIDAY*	

1. GENERAL WEATHER CONDITIONS

2. GENERAL COMMENTS

INSTANTANEOUS COUNT RECORD	3. TIME*							
	COUNT*							
4. NUMBER OF BOAT ANGLERS								
5. NUMBER OF SHORE/DOCK ANGLERS								
6. NUMBER OF WADING ANGLERS								
7. NUMBER OF FISHING BOATS								
8. NUMBER OF PLEASURE BOATS								
9. NUMBER OF CARS WITHOUT BOAT TRAILERS								
10. NUMBER OF CAR/TRAILER UNITS								
11. NUMBER OF OPEN ICE ANGLERS								
12. NUMBER OF ICE SHANTIES								
13. OTHER _____								

14. NUMBER OF ICE SHANTIES VISITED _____	15. NUMBER OF ICE SHANTIES FOUND UNOCCUPIED _____
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*Mandatory Information

APPENDIX B.

DEPARTMENT OF NATURAL RESOURCES

ANGLER INTERVIEW

FORM 3600-114

REV. 5-82

COUNTY	COUNTY CODE*	WATER NAME	WATER NUMBER*	1. <input type="checkbox"/> LAKE*	SHEET NUMBER*
CENSUS SITE	DATE (MONTH-DAY-YEAR)*		1. <input type="checkbox"/> WEEKDAY* 2. <input type="checkbox"/> WEEKEND/HOLIDAY*		

1* WAS THE ANGLER A: 1. <input type="checkbox"/> DRIVER 2. <input type="checkbox"/> PASSENGER 3. <input type="checkbox"/> NO VEHICLE 2. AGE: 1. <input type="checkbox"/> UNDER 16 3. <input type="checkbox"/> 65 & OVER 2. <input type="checkbox"/> 16-64 3. SEX: 1. <input type="checkbox"/> MALE 2. <input type="checkbox"/> FEMALE 4. ANGLER RESIDENCE: 1. <input type="checkbox"/> WIS. 2. <input type="checkbox"/> NON-RES. DISTANCE (MILES): 1. <input type="checkbox"/> 0-25 2. <input type="checkbox"/> 26-50 3. <input type="checkbox"/> OVER 50 WIS. COUNTY CODE OR NON-RESIDENT STATE: _____ 5. LICENSE: 1. <input type="checkbox"/> NONE 5. <input type="checkbox"/> ANNUAL 2. <input type="checkbox"/> SPORT 6. <input type="checkbox"/> FAMILY 3. <input type="checkbox"/> RES. COMB. 7. <input type="checkbox"/> 15-DAY 4. <input type="checkbox"/> PERM. RES. 8. <input type="checkbox"/> 4-DAY 6* NUMBER OF ANGLERS IN PARTY: _____	16. LENGTH IS RECORDED IN: 1. <input type="checkbox"/> INCHES & TENTHS 2. <input type="checkbox"/> CM & MM 17. WEIGHT IS RECORDED IN: 1. <input type="checkbox"/> POUNDS & OUNCES 2. <input type="checkbox"/> KGS. & GRAMS
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

SPECIES CODE	18. SPECIES	LENGTH		WEIGHT		FIN CLIP	TAG		TAG NUMBER
		IN. CM.	10TH MM.	LBS. KGS.	OZ. GMS.		TYPE	COLOR	
L. STURGEON	B01								
SHOVELNOSE	B02								
GAR, UNSP.	D00								
BOWFIN	E01								
HIODON, UNSP.	H00								
CISCO	I04								
L. WHITEFISH	I05								
COHO S.	I14								
CHINOOK S.	I16								
ATLANTIC S.	I20								
TROUT, UNSP.	I01								
RAINBOW T.	I19								
BROWN T.	I21								
BROOK T.	I22								
LAKE T.	I23								
TIGER T.	I27								
SPLAKE	I28								
SMELT	J01								
N. PIKE	L02								
MUSKIE	L03								
HYB. MUSKIE	L08								
CARP	M12								
BUFFALO, UNSP.	N03								
REDHORSE, UNSP.	N04								
SUCKER, UNSP.	N02								
WH. SUCKER	N09								
BULLHD., UNSP.	O00								
BLACK BHD.	O05								
BROWN BHD.	O07								
YELLOW BHD.	O06								
CH. CATFISH	O08								
FLATHD. CAT.	O12								
BURBOT	R01								
WHITE BASS	V01								
YELLOW BASS	V02								
PANFISH	Z97								
SUNFISH, UNSP.	W03								
ROCK BASS	W04								
GREEN SUNFISH	W05								
PUMPKINSEED	W06								
WARMOUTH	W07								
BLUEGILL	W09								
WH. CRAPPIE	W13								
BL. CRAPPIE	W14								
Y. PERCH	X15								
SM. BASS	W11								
LM. BASS	W12								
SAUGER	X21								
WALLEYE	X22								
FW. DRUM	Y01								

7. TYPE OF TACKLE (MAX. OF 2): 1. <input type="checkbox"/> SPINNING 4. <input type="checkbox"/> CANE POLE 2. <input type="checkbox"/> BAIT CASTING 5. <input type="checkbox"/> JIG POLE 3. <input type="checkbox"/> FLY 6. <input type="checkbox"/> TIP UP 7. <input type="checkbox"/> OTHER _____ 8. ANGLING METHOD (MAX. OF 2): 1. <input type="checkbox"/> STILL FISHING 4. <input type="checkbox"/> JIGGING 2. <input type="checkbox"/> CASTING 5. <input type="checkbox"/> SNAGGING 3. <input type="checkbox"/> TROLLING 6. <input type="checkbox"/> OTHER _____ 9. BAITS USED (MAX. OF 2): 1. <input type="checkbox"/> WORM 6. <input type="checkbox"/> SPOONS 2. <input type="checkbox"/> MINNOW 7. <input type="checkbox"/> PLUGS 3. <input type="checkbox"/> OTHER NAT. BAIT 8. <input type="checkbox"/> FLY 4. <input type="checkbox"/> PREPARED BAIT 9. <input type="checkbox"/> JIGS 5. <input type="checkbox"/> SPINNERS 10. <input type="checkbox"/> OTHER _____ 10. ANGLER WAS: 1. <input type="checkbox"/> GUIDED 2. <input type="checkbox"/> NOT GUIDED 11* FISHING WAS FROM: 1. <input type="checkbox"/> BOAT 2. <input type="checkbox"/> SHORE OR DOCK 4. <input type="checkbox"/> ICE SHANTY 3. <input type="checkbox"/> WADING 5. <input type="checkbox"/> OPEN ICE 12* COMPLETED FISHING: 1. <input type="checkbox"/> YES 2. <input type="checkbox"/> NO 13* TIME STARTED FISHING: _____ : _____ TIME INTERVIEWED OR 14* TIME ENDED FISHING: _____ : _____ 15* CATCH AND HARVEST INFORMATION: <table border="1"> <thead> <tr> <th>SPECIFICALLY FISHED FOR</th> <th>% OF TIME FISHED FOR</th> <th>NUMBER CAUGHT</th> <th>NUMBER KEPT</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>	SPECIFICALLY FISHED FOR	% OF TIME FISHED FOR	NUMBER CAUGHT	NUMBER KEPT																					19. COMMENTS:
SPECIFICALLY FISHED FOR	% OF TIME FISHED FOR	NUMBER CAUGHT	NUMBER KEPT																						

*MANDATORY INFORMATION

(COMMENT CODE)

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